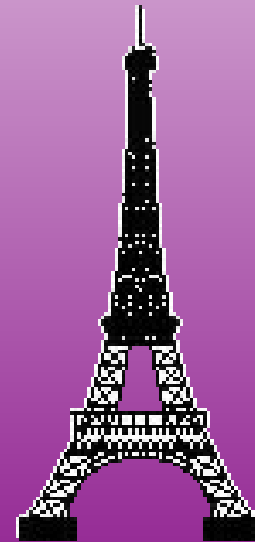


# Symmetry



*Mathematics is much more than finding sums, differences, products, and quotients. Mathematics is a way of looking at the world. As a mathematician, you view the world looking for regularity and order or the lack of order and regularity.*



# Symmetry: Symmetry Is All Around You!

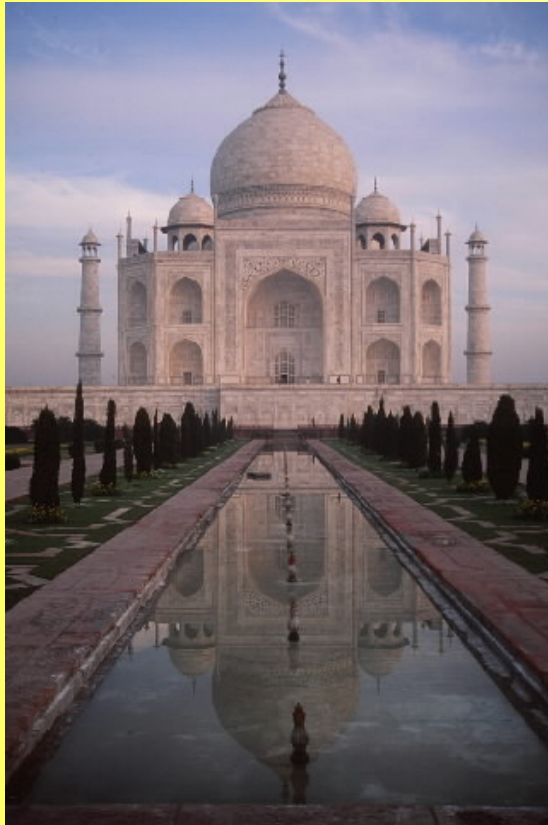
**We are surrounded by all types of symmetry**, a type of regularity and order--in nature, in architecture, in art and much more. Look carefully at the world around you. Did you know that there are THREE types of symmetry? The picture of the sea flower to the left possesses all three types of symmetry.

**LINE SYMMETRY**: The most common type of symmetry is **line symmetry**. A figure that can be folded in such a way that one-half of it lies exactly on the other half is said to have **line symmetry**.

**ROTATIONAL SYMMETRY**: A figure is said to have **rotational symmetry** if there exists a point around which the figure can be rotated less than one complete turn of 360 degrees in order to result in an identical figure.



**POINT SYMMETRY**: A figure is said to have **point symmetry** if it can be rotated one-half of a turn or 180 degrees about a point onto itself. After learning about these three types of symmetry you will begin to notice all of the **symmetry** in your world. Enjoy its beauty and the interest that it adds to your environment.



# Symmetry All Around You

## Line Symmetry

**Line Symmetry** is also known as **Bilateral Symmetry**

We are surrounded by all types of **symmetry**, a type of regularity and order--in nature, in architecture, in art and much more.

The most common type of **symmetry** is **line or bilateral symmetry**. A figure that can be folded in such a way that one-half of it lies exactly on the other half is said to have **line symmetry**. The two parts of the original pictures are mirror images of each other and are said to be congruent. [*Congruent* means that both parts have the same shape and the same size.] Look closely at the picture of the Taj Mahal on the left. Can you find where the line of symmetry is in this picture?



Explore these pages for activities and more information about LINE symmetry!

**Line Symmetry or Not?**

**Pattern Blocks**

**Letters**

**Activities**

**Extensions**

**Challenge**



**Line Symmetry Home**

**Letters**

**Line Symmetry or Not?**

**Activities**

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**Pattern Blocks**

**Challenge**

Line symmetry or not?

# Symmetry: Pattern Blocks and Line Symmetry

Let's look at the pattern blocks below. Find all of the different lines of symmetry for each pattern block. Pull out the pull tabs to check your answers.

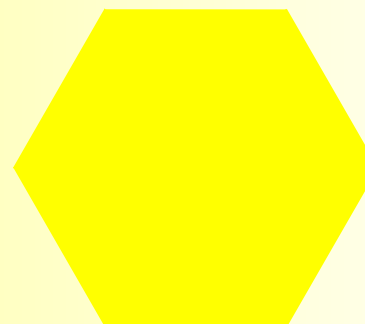
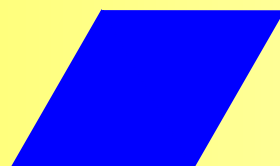
Square



Triangle



Rhombus



Trapezoid



Rhombus



Hexagon



[Line Symmetry Home](#)

[Letters](#)

[Activities](#)

[Line Symmetry or Not?](#)

[Extensions](#)

[Pattern Blocks](#)

[Challenge](#)



## Symmetry: Letters and Line Symmetry

Which capital letters have line symmetry?

A B C D E F G H I  
J K L M N O P Q R  
S T U V W X Y Z

Have you ever stopped to think about the symmetry of the capital letters? For example, the letter A has line symmetry but the letter F does not. Draw the lines of symmetry for the letters above if any exist. Circle the letters that do NOT have line symmetry.

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[Line Symmetry or Not?](#)

[Pattern Blocks](#)

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# Lines of Symmetry

## Answers

### Letters with line symmetry

A, B, C, D, E, H, I, M, O, T, U, V, W, X, Y

### Letters without line symmetry

F, G, J, K, L, N, P, Q, R, S, Z

- Did you find all the letters with line symmetry?
- Do some letters have more than one line of symmetry?
- Does the font style have anything to do with the lines of symmetry? Explain.

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[Letters](#)

[Line Symmetry or Not?](#)

[Activities](#)

[Pattern Blocks](#)

[Extensions](#)

[Challenge](#)

# Symmetry: Activities in Line Symmetry



1. Make a picture that has line symmetry, tell how many lines of symmetry it has, and draw them on the picture.
2. Make a picture that DOES NOT have line symmetry. Explain how you know.

**Line Symmetry Home**

**Letters**

**Line Symmetry or Not?**

**Activities**

**Extensions**

**Extensions**

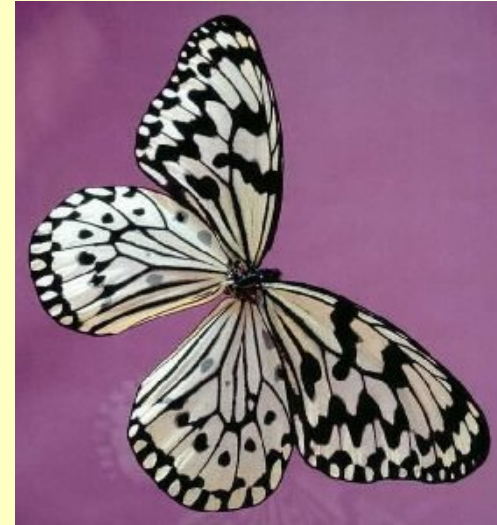
**Pattern Blocks**

**Challenge**



## Symmetry: Extension Activities

1. Think of a beautiful butterfly. Butterflies have **line symmetry**. Find other things in nature that have **line symmetry** and draw it, cut the picture out of a magazine, or take a photo of it.



2. Find an object in your house with **line symmetry** and draw it, cut the picture out of a magazine, or take a photo of it.

3. Find something with exactly one **line of symmetry** and draw it, cut the picture out of a magazine, or take a photo of it.

4. Can you find something with an infinite number of **lines of symmetry**? If so, what is it?

**Line Symmetry Home**

**Letters**

**Line Symmetry or Not?**

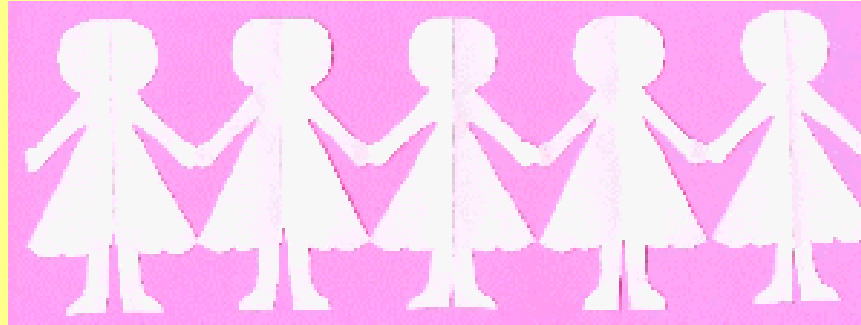
**Activities**

**Pattern Blocks**

**Extensions**

**Challenge**

# Symmetry: Challenge Problem



Using what you know about line symmetry, fold and cut a piece of paper to make a chain of paper dolls - girls, boys, animals, etc.

**Line Symmetry Home**

**Letters**

**Line Symmetry or Not?**

**Activities**

**Pattern Blocks**

**Extensions**

**Challenge**

## Symmetry All Around You - Rotational Symmetry

**Rotational Symmetry** is also known as **Radial Symmetry**.

We are surrounded by all types of **symmetry**, a type of regularity and order--in nature, in architecture, in art and much more.



It is common to find objects with **rotational symmetry**. A figure can be turned about a point less than 360 degrees and land on an image of itself is said to have **rotational symmetry**. Another way of thinking of rotational symmetry is seeing an image arranged in rays diverging from a single point. That point is called the **center of rotation**.

The pinwheel has **rotational symmetry**. The point in the middle of the pinwheel is the **center of rotation**. If you ignore the colors and focus only on the shape, the pinwheel has an **order** of 7 and **magnitude** of  $360/7$  or  $51\frac{3}{7}$  degrees. The **order** is found by determining how many stops you can make while turning in a circle matching the original image. The **magnitude** is found by dividing 360 degrees by the **order**.

Explore these pages for activities and more information about



Rotational symmetry!

**Rotational Symmetry or Not?**

**Pattern Blocks**

**Hub Caps**

**Activities**

**Extensions**



**Rotational Symmetry Home**

**Rotational Symmetry or Not?**

**Pattern Blocks**

**Hub Caps**

**Activities**

**Extensions**

**Challenge**

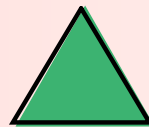
Rotational symmetry or not?

# Symmetry: Pattern Blocks and Rotational Symmetry

Let's take a look at the pattern blocks below. Find all of the pattern blocks with **rotational symmetry**. (Each can be rotated to test it.) If it has **rotational symmetry**,

- put a dot on the **Center of Rotation** and mark it "C"
- write its **order** and
- write its **magnitude**.

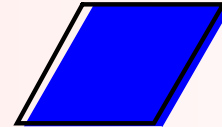
If you want to check your answers, click on the rectangle to reveal them.



order = \_\_\_\_\_

mag = \_\_\_\_\_

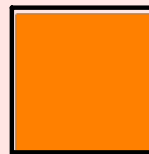
Answer



order = \_\_\_\_\_

mag = \_\_\_\_\_

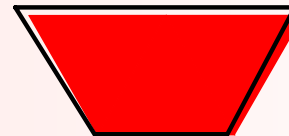
order = 2 mag = 180°  
Answer



order = \_\_\_\_\_

mag = \_\_\_\_\_

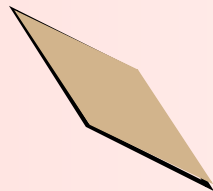
Answer



order = \_\_\_\_\_

mag = \_\_\_\_\_

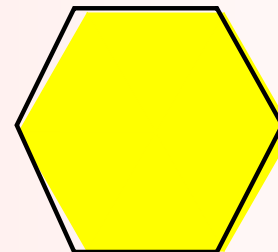
Answer



order = \_\_\_\_\_

mag = \_\_\_\_\_

Answer



order = \_\_\_\_\_

mag = \_\_\_\_\_

Answer

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[Pattern Blocks](#)




[Hub Caps](#)

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# Symmetry:

## Hub Caps and Rotational Symmetry

Hub Cap				
Order	•	•	•	•
Magnitude	•	•	•	•

A good source of objects that have **rotational symmetry** happen to be hub caps. Have you noticed? Take a look at the four hub caps above. All have **rotational symmetry**. Now it's your turn. See if you can give the order of each and their magnitudes and when you're done, check them.

Take a look at cars and see what other kinds of hubcaps possess **rotational symmetry**. Can you find any hub caps that don't have **rotational symmetry**?

Rotational Symmetry Home

Rotational Symmetry or Not?

Pattern Blocks

Hub Caps

Activities

Extensions

# Symmetry:

## Activity in Rotational Symmetry

a. Make a picture that has **rotational symmetry** and its order and magnitude.

b. Make a picture that **DOES NOT** have line symmetry but has **rotational symmetry**.



---

**Rotational Symmetry Home**

**Rotational Symmetry or Not?**

**Pattern Blocks**

**Hub Caps**

**Activities**

**Extensions**



## Symmetry: Extension Activities in Rotational Symmetry

a) Can you find other things in nature that have rotational symmetry and draw it, cut the phot out of a magazine, or take a photo of it. Take a look at the cross-sections of fruits, vegetables, or plants. Do they have rotational symmetry?

b) Find some toys or sports equipment with rotational symmetry. Draw them, cut photos out of a magazine, or take a photo of them.



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**Rotational Symmetry Home**

**Rotational Symmetry or Not?**

**Pattern Blocks**

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**Activities**

**Extensions**

## Symmetry: Challenge Problem



Using what you know about **rotational symmetry** can you **fold and cut** a figure that has **rotational symmetry** with an **odd order**?

---

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## Symmetry All Around You - Point Symmetry

The symmetry that is the least talked about is **point symmetry** even though it can be spotted everywhere in the world around you. **Point symmetry** is a special subset of **rotational symmetry**. In other words, any figure that has **point symmetry** automatically has **rotational symmetry**. However, any figure with **rotational symmetry** may or may not have **point symmetry**.



A figure that can be turned about a point  $180^\circ$  and land on an image of itself is said to have **point symmetry** and rotational symmetry of order 2. Another way to check for **point symmetry** is to turn it upside down ( $180^\circ$ ) and see if it looks exactly the same. The picture of the volleyball has **point symmetry**. It has **rotational symmetry** of **order 2** and **magnitude of  $180^\circ$**  and so it also has **point symmetry**.

When you are looking at the examples on the next page of **point symmetry** find the **order** of rotation for the figures with and without **point symmetry** to see if you can find the pattern.

Explore these pages for activities and more information about **point symmetry**.

**Point Symmetry or Not?**

**Pattern Blocks**

**Deck of Cards**

**Activities**

**Extensions**

**Challenge**





**Point Symmetry Home**

**Point Symmetry or Not?**

**Pattern Blocks**

**Deck of Cards**

**Activities**

**Extensions**







**Challenge**

Point symmetry or not?

## Symmetry: Pattern Blocks and Point Symmetry

Let's take a look at the pattern blocks below. Find all of the pattern blocks with **point symmetry**. If it has **point symmetry**, write its order and magnitude.

What is true of the order of objects with **point symmetry**?

Pattern Block	Point Symmetry?	Order?	Magnitude?
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

---

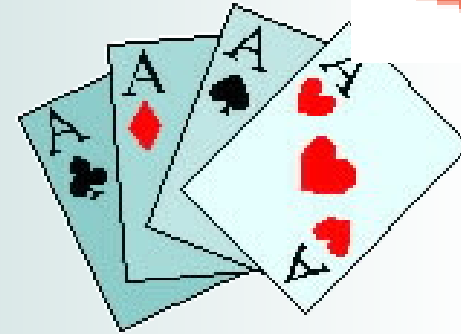
[Point Symmetry Home](#)
[Point Symmetry or Not?](#)
[Pattern Blocks](#)  
[Deck of Cards](#)
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[Extensions](#)
[Challenge](#)

## Symmetry: Playing Cards and Point Symm

In a standard deck of playing cards, which cards have **point symmetry**?

Make a list and name both the suit and the cards with and without **point symmetry**.

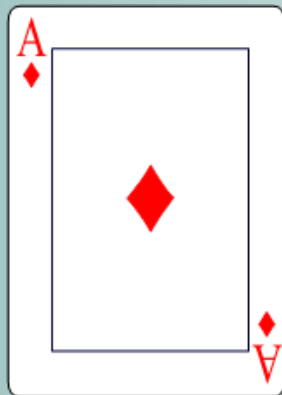
Be careful... Some are tricky.



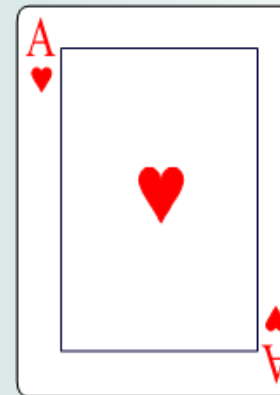
**Ace of diamonds** does have **point symmetry**.

**Ace of hearts** does not have **point symmetry**.

why?



Do all diamonds have **point symmetry**?



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[Deck of Cards](#) [Activities](#) [Extensions](#) [Challenge](#)

## Symmetry: Playing Cards and Point Symmetry

These cards have **point symmetry**. Why is this true and what is the order/magnitude of each? Are there any surprises?



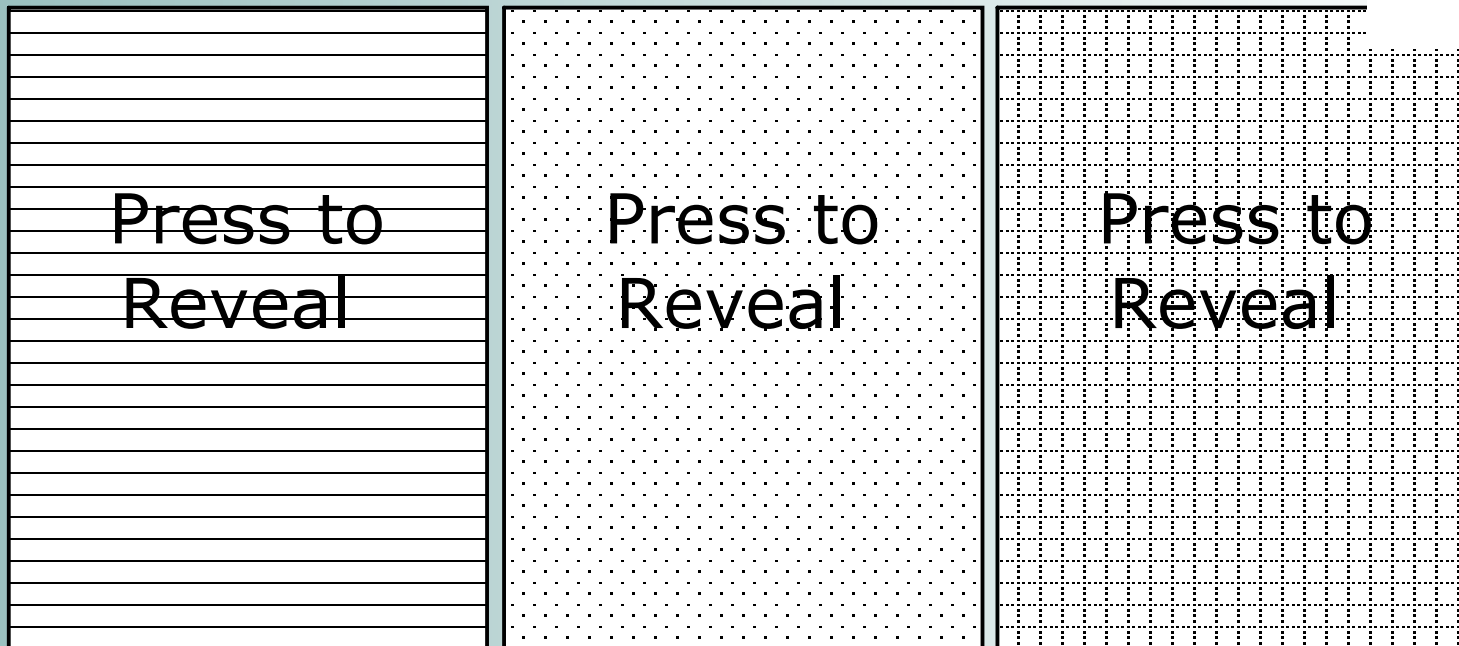
See the other cards -  
the [cards with NO Point Symmetry](#).

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These cards do NOT have **point symmetry**.  
Why don't they? Were there any surprises? Explain



Before you finish with your deck of cards, turn the cards over and take a look.

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[Deck of Cards](#)

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**Lots of Symmetry!**

When you first looked at a deck of cards I would guess that you didn't realize all of the symmetry it had to share with you. These designs are pretty detailed. Which have **POINT symmetry**? Which have **ROTATIONAL Symmetry**? Which have **LINE symmetry**?

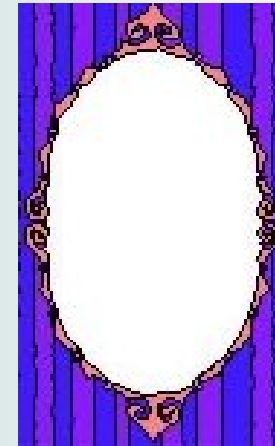


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[Deck of Cards](#) [Activities](#) [Extensions](#) [Challenge](#)

# Symmetry: Activities in Rotational Symmetry

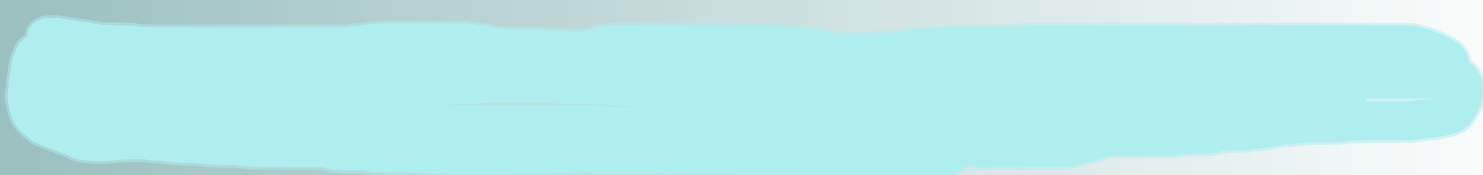
This picture has both **point** and **rotational** symmetry of order 2.



a. Draw a picture with **point symmetry** and **rotational symmetry** of order 2.

b. Make a picture that DOES NOT have **point symmetry** but DOES have **rotational symmetry**.

c. If an image has **rotational symmetry**, how can you quickly tell if it has **point symmetry**? Can you find a rule for the **order** and/or **magnitude** of a figure that will guarantee an object that has **rotational symmetry** will also have **point symmetry**?



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<a href="#">Point Symmetry Home</a>	<a href="#">Point Symmetry or Not?</a>	<a href="#">Pattern Blocks</a>
<a href="#">Deck of Cards</a>	<a href="#">Activities</a>	<a href="#">Extensions</a>
		<a href="#">Challenge</a>

## Symmetry: Extension Problems



1. Many plants have point symmetry. this one lives under water and is called a seaflower. Can you find other things in nature with point symmetry? Draw them, cut a picture out of magazine, or take photos of them.

2. Find an object in your house with point symmetry. Draw them, cut a picture out of magazine, or take photos of them.

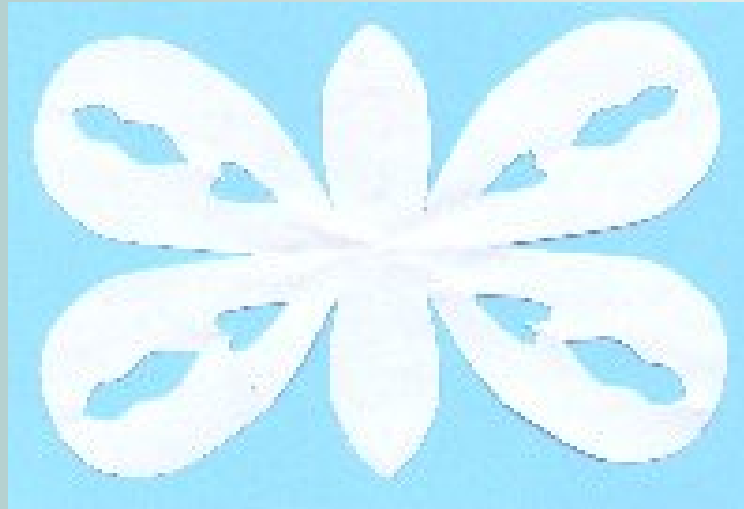
3. This is a picture of a face of an old compass. Are there other historical treasures that have point symmetry. You'll have to search in many places to find some of these.



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<a href="#">Point Symmetry Home</a>	<a href="#">Point Symmetry or Not?</a>	<a href="#">Pattern Blocks</a>
<a href="#">Deck of Cards</a>	<a href="#">Activities</a>	<a href="#">Extensions</a>
		<a href="#">Challenge</a>

## Symmetry: Challenge Problem



Using what you know about **point symmetry**, can you fold and cut out a piece of paper to make a figure with **point symmetry** - like this one?

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<a href="#">Point Symmetry Home</a>	<a href="#">Point Symmetry or Not?</a>	<a href="#">Pattern Blocks</a>
<a href="#">Deck of Cards</a>	<a href="#">Activities</a>	<a href="#">Extensions</a>
		<a href="#">Challenge</a>

# symmetry

<http://teachersnetwork.org/dcs/math/symmetry/index.htm>

Line Symmetry <http://teachersnetwork.org/dcs/math/symmetry/Linesymmetry/>

Rotational Symmetry <http://teachersnetwork.org/dcs/math/symmetry/rotational/>

Point Symmetry <http://teachersnetwork.org/dcs/math/symmetry/Point/>

## Attachments

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Symmetry Lab key.doc

SymmetryLabWorksheet.doc